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GKN Driveline International GmbH
Hauptstrasse 130
53797 Lohmar

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Counter track joint with track turning point

1. A constant velocity joint (11) in the form of a counter track joint with the following characteristics:
an outer joint part (12) which comprises a first longitudinal axis (A_{12}) and an attaching end and an aperture end which are axially opposed relative to one another, and which outer joint part (12) further comprises first outer ball tracks (18) and second outer ball tracks (20);
an inner joint part (15) which comprises a second longitudinal axis (A_{22}) and attaching means for a shaft (22) pointing to the aperture end of the outer joint part (12), and which inner joint part (15) comprises first inner ball tracks (19) and second inner ball tracks (21);
the first outer ball tracks (18) and the first inner ball tracks (19) form first pairs of tracks with one another;
the second outer ball tracks (20) and the second inner ball tracks (21) form second pairs of tracks with one another; the pairs of tracks each accommodate a torque transmitting ball (17_1, 17_2);
a ball cage (16) is positioned between the outer joint part (12) and the inner joint part (15) and comprises circumferentially distributed cage windows (24_1, 24_2) which each accommodate at least one of the balls (17_1, 17_2);
when the joint is in the aligned condition, the aperture angle δ_1 of the first pairs of tracks opens in the central joint plane (E) from the aperture end to the attaching end of the outer joint part (12);
when the joint is in the aligned condition, the aperture angle δ_2 of the second pairs of tracks opens in the cen-

tral joint plane (E) from the attaching end to the aperture end of the outer joint part (12),

characterised in

that central track lines (L_{18}, L_{19}) of the first pairs of tracks each have a turning point (T_{1-2}) and that a centre angle (β) at the turning point (T_{1-2}), with reference to the central joint plane (E), is greater than 4°.

2. A constant velocity joint according to claim 1,

characterised in

that the centre angle (β) at the turning point (T_{1-2}), with reference to the central joint plane (E) is greater than 5°.

3. A joint according to claim 1,

characterised in

that the centre angle (β) at the turning point (T_{1-2}), with reference to the central joint plane (E), is smaller than 12°.

4. A constant velocity joint according to any one of claims 1 to 3,

characterised in

that a tangent at the central track lines (L_{18}, L_{19}) of the first pairs of tracks in the turning point (T_{1-2}) forms a turning point angle (α) with the respective longitudinal

axis (A_{12}, A_{22}) and that a perpendicular line on said tangent forms a turning point angle (α) with the central joint plane (E), which is defined by

$$\alpha \geq \beta - \arcsin\left[\frac{O_2}{R_2} \cdot \sin\left(\beta + 90°\right)\right]$$

wherein O_2 is the axial distance of the point of intersection of a perpendicular line on the tangent and the respective longitudinal axis (A_{12}, A_{22}) and wherein R2 is the distance of said point of intersection from the turning point (T_{1-2}).

5. A constant velocity joint according to claim 4,

characterised in

that a turning point angle (α) is defined by

$$\alpha \geq \beta + \arcsin\left[\frac{O_2 + a \cdot \tan(\beta)}{R_2} \cdot \sin\left(\beta + 90°\right)\right]$$

if the respective central track line (L_{13}, L_{19}) from the central joint plane (E) to the turning point (T_{1-2}) comprises a radius (R_2) whose centre (M_2) comprises an axial distance (O_2) from the central joint plane (E) and a radial distance (a) from the respective longitudinal axis (A_{12}, A_{22}) towards the turning point (T_{1-2}).

6. A constant velocity joint according to claim 4,

characterised in

that the turning point angle (α) is defined by

$$\alpha \geq \beta + \arcsin\left[\frac{O_2 - b \cdot \tan(\beta)}{R_2} \cdot \sin(\beta + 90°)\right]$$

if the respective central track line (L_{18}, L_{19}) in the central joint plane (E) up to the turning point (T_{1-2}) comprises a radius (R_2) whose centre (M_2) comprises an axial distance (O_2) from the central joint plane (E) and a radial distance (b) from the respective longitudinal axis (A_{12}, A_{22}) towards the turning point (T_{1-2}).

7. A constant velocity joint according to any one of claims 1 to 6,

characterised in

that the central track lines (L_{18}, L_{19}) are composed of a radius (R_2) and, as from the turning point (T_{1-2}), of a counter radius (R_1).

8. A constant velocity joint according to any one of claims 1 to 6,

characterised in

that the central track lines (L_{18}, L_{19}) are composed of a radius (R_2) and, as from the turning point (T_{1-2}), of a counter radius (R_1) as well as of a smaller radius (R_3) which smaller radius (R_3) adjoins the radius (R_2) on the opposite side and has the same sense of curvature.

9. A constant velocity joint according to any one of claims 1 to 6,

characterised in

that the central track lines (L_{18}, L_{19}) are composed of a

radius (R_2), of a straight line following the radius (R_2) from the turning point (T_{1-2}) on, and of a smaller radius (R_3), which smaller radius (R_3) adjoins the radius (R_2) on the opposite side and has the same sense of curvature. (Figure 16).

10. A constant velocity joint according to any one of claims 1 to 9,

characterised in

that the central track lines (L_{20}, L_{21}) of the second ball tracks are composed of a radius (R_5) and an axis-parallel straight line which follows the radius (R_5) towards the aperture end (Figure 9).

11. A constant velocity joint according to any one of claims 1 to 9,

characterised in

that the central track lines (L_{20}, L_{21}) of the second ball tracks are composed of a radius (R_5) and a counter radius (R_4) which follows towards the aperture end (Figure 10).

12. A constant velocity joint according to any one of claims 1 to 9,

characterised in

that the central track lines (L_{20}, L_{21}) of the second ball tracks are formed of a radius (R_5) (Figure 12).

13. A constant velocity joint according to any one of claims 1 to 12,

characterised in

that the joint is 6-ball joint.

14. A constant velocity joint according to any one of claims 1 to 12,

characterised in

that the joint is an 8-ball joint.

15. A constant velocity joint according to any one of claims 1 to 12,

characterised in

that the cage windows (24_1) for the first balls (17_1) are shorter in the circumferential direction than the cage windows (24_2) for the second balls (17_2).

16. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the radius of curvature R_1, the following applies:

$$1.5 < PCDB / R1 < 1.9.$$

17. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the radius of curvature R_2, the following applies:

$$1.8 < PCDB / R2 < 2.2.$$

18. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the radius of curvature R_3, the following applies:

$$2.3 < PCDB / R3 < 2.7.$$

19. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the radius of curvature R_4, the following applies:

$$2.1 < PCDB / R4 < 2.5.$$

20. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the radius of curvature R_5, the following applies:

$$1.8 < PCDB / R5 < 2.2.$$

21. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the axial centre offset O_2 of the radius of curvature R_2, the following applies:

$$12 < PCDB / 02 < 16.$$

22. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the axial centre offset O_5 of the radius of curvature R_5, the following applies:

$$12 < PCDB / 05 < 16.$$

23. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the outer diameter OD of the outer joint part (12), the following applies:

$$0.6 < PCDB / OD < 0.8.$$

24. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the axial length L of the inner joint part (15), the following applies:

$$2.1 < PCDB / L < 2.5.$$

25. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the ball diameter DB, the following applies:

$$3.4 < PCDB / DB < 4.0.$$

26. A constant velocity joint according to any one of claims 1 to 13 and claim 14,

characterised in

that for the ratio of the pitch circle diameter of the balls PCDB and the pitch circle radius PCDS of the plug-in aperture of the inner joint part (15), the following applies:

$$2.1 < PCDB / PCDS < 2.5.$$

27. A constant velocity joint according to any one of claims 1 to 12 and claim 14,

characterised in

that for the ratio of the pitch circle diameter PCDB and the outer diameter DCA of the ball cage (16), the following applies:

$$0.75 < PCDB / DCA < 1.05.$$

28. A constant velocity joint according to any one of claims 1 to 12 and claim 14,

characterised in

that for the ratio of the pitch circle diameter PCDB and the inner diameter DCI of the ball cage (16), the following applies:

$$0.85 < PCDB / DCI < 1.15.$$

29. A constant velocity joint according to any one of claims 1 to 12 and claim 14,

characterised in

that for the ratio of the pitch circle diameter PCDB and the circumferential web width W of the ball cage (16), the following applies:

$$7.5 < PCDB / W < 11.5.$$

30. A constant velocity joint according to any one of claims 1 to 12 and claim 14,

characterised in

that for the ratio of the pitch circle diameter PCDB and the circumferential length L1 of the first cage windows (23), the following applies:

$$2.8 < PCDB / L1 < 3.4.$$

31. A constant velocity joint according to any one of claims 1 to 12 and claim 14,

characterised in

that for the ratio of the pitch circle diameter PCDB and the circumferential length L2 of the second cage windows (24), the following applies:

$$2.6 < PCDB / L2 < 3.2.$$

32. A driveshaft comprising two constant velocity joints and an intermediate shaft,

characterised in

that at least one of the constant velocity joints (11, 31) is designed according to one of claims 1 to 31.

33. A driveshaft according to claim 32,

characterised in

that the intermediate shaft comprises an axial plunging unit (28).

34. A motor vehicle having at least two driveshafts which each comprise two constant velocity joints and an intermediate shaft and which each, in the form of sideshafts, connect a differential drive with a wheel hub unit,

characterised in

that at least one of the joints (11, 31) of each driveshaft is designed according to any one of claims 1 to 31 and that a shaft journal of same is inserted into the differential drive (32).

35. A motor vehicle having at least two driveshafts which each comprise two constant velocity joints and an intermediate shaft and which each, in the form of sideshafts, connect a differential drive with a wheel hub unit,

characterised in

that at least one of the joints (11, 31) of each drive-shaft is designed according to any one of claims 1 to 31 and that a shaft journal of same is inserted into the wheel hub unit (33).